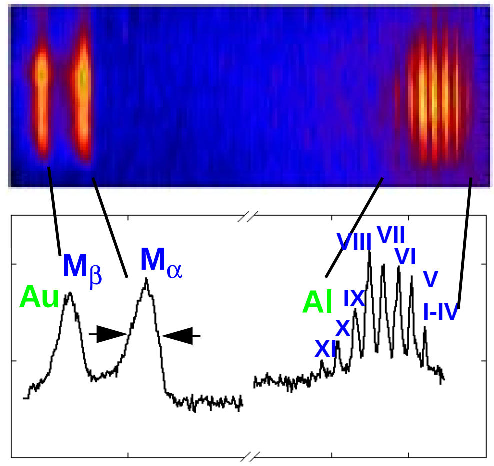
May 1994 Highlights of the Light Ion Inertial Confinement Fusion Program



Modeling of x-ray spectra can provide a detailed accounting of the relevant atomic states in PBFA-II target experiments.

We produced a new version of the Light Ion ICF Technical Contract. To complete the milestones in the August 1993 draft, an increased level of support, as suggested by the Inertial Confinement Fusion Advisory Committee, would be required. Because of the reduction in the FY94 budget, we stretched the delivery date of our milestones and eliminated some low priority objectives. These changes, as well as an update of our program accomplishments, are formally documented in the latest (May 23) draft of the technical contract.

Our near-term milestone of a 100 eV radiation temperature by March 1995 in an ion-driven hohlraum requires an increase in lithium beam intensity from 1.4 TW/cm^2 to 5 TW/cm^2. The intensity increase can be obtained through an increase in the coupled lithium power and a decrease in the lithium beam divergence. PBFA-II experiments indicate that the beam intensity is limited by a “parasitic load” carried by energetic high-Z ions and that the beam divergence is caused mainly by the LiF source divergence and possibly by azimuthal electric field nonuniformities. Experimentally, we define the parasitic load as the difference between the total ion current seen in gas-cell current monitors and the lithium ions measured by filtered Faraday cups and by on-axis diagnostics such as the magnetic spectrometer. Visible spectroscopic data reveal anode and cathode plasmas that could be the source of these parasitic ions and could also contribute to the electric field nonuniformities. Cleaning the diode electrodes could eliminate the source of the parasitic ions. We plan to combine heating, RF-discharge cleaning, and titanium gettering to clean the diode and improve the diode vacuum. Circuit model simulations predict a factor of two increase in the coupled ion power on PBFA II in the absence of the parasitic load.

K_α satellite spectroscopic data are obtained in PBFA-II lithium beam experiments (see figure). Emission and absorption spectra from tracer elements can be used to diagnose conditions in an ion-beam-heated target because of the sensitivity of the spectra to temperature and density. Under contract to our program, researchers at the University of Wisconsin are performing collisional radiative equilibrium calculations that include a detailed accounting of the relevant atomic states and the effect of Doppler, Auger, and Stark broadening on the spectral line profiles. Comparison of such simulations with the experimental spectra will provide an estimate of the density and temperature of the target plasma.

The anode hardware on SABRE is being modified to move the emission surface closer to the anode coils. The resulting concave magnetic field profiles are expected to improve ion efficiency and the uniformity of ion emission from the anode source area. The new coils became available for testing this month.

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Archived copies of the *Highlights* beginning July 1993 are available at http://www.sandia.gov/pulspowr/hedicf/highlights.